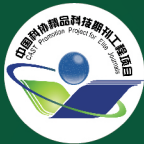


6

2018
第37卷
EI收录期刊

化工进展

Chemical Industry and Engineering Progress



中国化工学会会刊

Journal of Chemical Industry and Engineering Society of China

ISSN 1000-6613 / CN 11-1954/TQ

化工进展

第三十七卷

第六期

二〇一八年六月



欢迎扫码关注
化工进展微信公众号

主办 中国化工学会
 化学工业出版社



目次

特约评述

金属卟啉催化氧化环己烷最新研究进展·····沈海民, 王岩, 余远斌(2031)

化工过程与装备

旋转泡沫填料反应器的研究进展·····杨宇成, 杨时颖, MOSES Arowo(2046)
流程工业智能工厂建设的再思考·····赵路军, 荣冈(2053)
带经济成本函数的区间预测控制·····胡铭菲, 许莹, 罗雄麟(2060)
超亲水/超疏水匹配超薄热管的传热特性·····刘昌泉, 徐进良, 纪献兵(2067)
基于适应策略差分进化算法的化工反应动力学参数估值·····徐斌, 陈旭, 陶莉莉, 张海峰(2077)
新型径向叶片式旋转床压降分析及气相流场模拟·····陆佳冬, 王广全, 唐迪, 耿康生, 郑斌, 计建炳(2084)
水平窄矩形通道内液固两相的流动特性·····任立波, 赵新强, 张少峰(2092)
固体碱渣解聚均质器结构试验与数值模拟·····赵斌, 高明非, 杜亚杰, 霍殿龙(2101)
网纹内管双套管双管板安全型换热器的传热性能·····马乾, 刘雪东, 温传美, 谢红笑, 尹传忠(2109)
正火预处理对脉动热管启动时间的影响·····王瑞祥, 闫梦霏, 徐荣吉, 邢美波(2116)
氧化铜-碳纳米管/水混合纳米流体的光热性能·····屈健, 张若梅, 田敏(2125)
隔网对压力延迟渗透过程性能的影响·····孙硕程, 刘益伦, 陈曦(2132)

能源加工与技术

新常态下的炼化企业数字化转型——从数字炼化走向智慧炼化·····吴青(2140)
制氢技术的生命周期评价研究进展·····谢欣烁, 杨卫娟, 施伟, 张圣胜, 王智化, 周俊虎(2147)
NaOH/尿素冻融预处理纤维素及其酸催化水解·····邢静润, 申锋, 仇莱, 漆新华(2159)
生物柴油浸没喷吹的雾化特性·····邓伟鹏, 张小辉, 冯立斌, 王华(2166)
改性 HZSM-5 催化微波预处理竹木快速热解·····石坤, 仲兆平, 王佳, 李昭莹(2175)
含蜡和防聚剂体系天然气水合物浆液生成及流动特性
·····史博会, 雍宇, 柳杨, 李墨竹, 丁麟, 吕晓方, 吴海浩, 宫敬(2182)
低温煤焦油加氢制备清洁燃料油品中试试验研究·····崔文岗, 李冬, 樊安, 潘柳依, 牛梦龙, 李稳宏(2192)
多孔介质与 SDS 复配体系中天然气水合物生成过程分析
·····刘志明, 商丽艳, 潘振, 孙秀丽, 王喆, 侯朋朋(2203)

工业催化

甘油氢解制备 1,2-丙二醇催化剂的研究进展·····王辉国, 汪宏宇, 罗国华, 徐新(2214)
硅改性对石脑油择形改质催化剂性能的影响
·····王银斌, 汪洋, 臧甲忠, 郭春垒, 彭晓伟, 刘冠锋, 于海斌(2222)
四氢呋喃连续催化胺化制备四氢吡咯催化剂及工艺·····查杰, 钱俊峰, 孙富安, 陈圣春, 何明阳, 陈群(2230)
介孔磷酸铝固体酸催化剂的制备及其催化性能·····于波, 刘超, 刘金东, 丁万昱, 柴卫平(2236)
锰铈改性钒钨钛中低温 SCR 催化剂脱硝及抗水抗硫性能
·····黄金, 仲兆平, 朱林, 薛建明, 许月阳, 吴培亭(2242)
Co/Cu-USY 分子筛制备及催化乙苯氧化性能·····丁巍, 郝元川, 孙宇, 沈健(2249)

材料科学与技术

过冷水合盐相变材料跨季节储存太阳能研究进展·····朱茂川, 周国兵, 杨霏, 田富宽(2256)
沸石材料的改性及其对水体污染物的吸附性能·····王琳琳, 张智明, 丁阿强, 程然, 张铭杰, 吴东雷(2269)
储盐类融雪抑冰材料对沥青混合料性能影响研究进展·····张争奇, 罗要飞, 赵富强(2282)
聚碳酸酯二元醇的合成及应用研究进展·····宋孟璐, 杨先贵, 蔡晓东, 王公应(2295)
介孔纳米片构筑具有微纳分级结构的 ZnCo₂O₄ 微米花及制备高比能锂离子电池·····王天星, 王贺权(2302)
柔性 CuS 透明导电薄膜的制备及性能表征·····孙月月, 吕丽云, 王虹(2309)
酚醛树脂的改性及其浸渍石墨性能·····蒋凤易, 田蒙奎, 郝立通, 邵珠花, 杨颖, 罗祥丽(2316)
石墨烯复合相变微胶囊悬浮液的对流换热特性
·····申俊锋, 邹得球, 刘小诗, 郭江荣, 胡云平, 胡志钢, 刘默(2323)
稀土电解槽石墨内衬氧化扩散与孔隙结构演化模型·····刘庆生, 李江霖, 曾少军, 廖春发(2331)
玉米芯电容炭的制备及其电化学性能
·····屈笑笑, 邢宝林, 康伟伟, 张传涛, 黄光许, 赵会会, 田野, 郭梦瑶, 张传祥(2340)

生物与医药化工

- 平衡磷酸烯醇式丙酮酸节点通量强化筑波链霉菌合成他克莫司
..... 吕蒙蒙, 刘蛟, 刘欢欢, 陈红, 王成, 闻建平(2347)
- 产壳聚糖酶菌株 ncps116 发酵条件优化及其酶学性质
..... 张翔, 张彦昊, 刘孝永, 辛雪, 王易芬, 陈蕾蕾, 周庆新, 赵双枝(2354)

精细化工

- 磷酸酯功能单体对聚羧酸减水剂抗泥性能的影响.....张光华, 危静, 崔鸿跃(2364)
- 两性离子抑制剂的合成及性能.....杨彦东, 戎克生, 徐生江, 李建国, 于永生, 李佳(2370)

资源与环境化工

- 市政污泥热力干化过程中黏滞特性研究进展.....刘亚军, 王爱春, 邓文义(2378)
- 邻碘苯甲酸铵循环去除粗氧化铈中的铈和铈.....刘卫, 何捍卫, 尹志芳, 杨决, 陈月华(2386)
- CaO/PAC 混合絮凝剂的沼液净化性能.....涂特, 冉毅, 贺清尧, 梁飞虹, 王明, 晏水平(2392)
- CuO-Fe₂O₃/γ-Al₂O₃/H₂O₂/O₃ 催化氧化深度处理制药二级生化出水.....杨文玲, 郜子兴, 吴赳, 王妨茶(2399)
- 燃煤烟气化学吸收碳捕集系统分析与优化.....何卉, 方梦祥, 王涛, 葛坤(2406)

应用技术

- 电除尘器飞灰粒径表征及细颗粒降温团聚.....刘含笑, 郇建国, 姚宇平, 何毓忠, 陈招妹, 王鹏(2413)
- 热集成变压精馏分离乙二胺-水共沸体系的模拟优化.....何晓旭, 钱欣瑞, 鄢烈祥, 史彬(2426)
- 清洁工艺不溶性硫磺生产全钢胎带束层性能.....王荣杰, 沈本贤, 刘纪昌, 赵基钢(2432)
- 替代燃油的计算机辅助设计方法.....张磊, 刘琳琳, 都健(2438)

产品与市场

- 精对苯二甲酸产品和方法标准的研究进展.....张丽君, 丁大喜, 钱彦虎, 张育红, 李顶松, 戴玉娣(2445)

广告索引

- | | |
|------------------------|----------------------------------|
| 封面: 北京三聚环保新材料股份有限公司 | 彩插 11: 天津市新天进科技开发有限公司 |
| 封二: 精馏技术国家工程研究中心(天津大学) | 彩插 12: 苏州顶裕节能设备有限公司 |
| 封三: 北京世纪森朗实验仪器有限公司 | 彩插 13: 北京三聚环保新材料股份有限公司 |
| 封四: 中山大学惠州研究院 | 彩插 14: 天津市创举科技有限公司 |
| 彩插 1: 青岛科大隆腾科技发展有限公司 | 彩插 15: 合众高科(北京)环保技术股份有限公司 |
| 彩插 2: 北京泽华化学工程有限公司 | 彩插 16: 烟台信亚精馏设备高新技术有限公司 |
| 彩插 3: 北京泽华化学工程有限公司 | 彩插 17: 常州大学石油化工学院 |
| 彩插 4: 沈阳奥吉娜化工有限公司 | 彩插 18: 中国石油化工股份有限公司大连石油
化工研究院 |
| 彩插 5: 沈阳奥吉娜化工有限公司 | 内插 1: 广西碳酸钙产业化工程院 |
| 彩插 6: 石家庄波特无机膜分离设备有限公司 | 内插 2: 南通富莱克流体装备有限公司 |
| 彩插 7: 山东省淄博三剂化工设备有限公司 | 内插 3: 浙江东瓯过滤机械制造有限公司 |
| 彩插 8: 北京北化工程技术有限公司 | 内插 4: 上海申银机械(集团)有限公司 |
| 彩插 9: 四川天一科技股份有限公司 | |
| 彩插 10: 中圣科技(江苏)有限公司 | |

责任编辑 奚志刚

英文顾问 蔡家琦, 李保庆, 龙秉文, 王运东

主管	中国科学技术协会	主 编	谭天伟	国际标准刊号	ISSN 1000-6613
主办	中国化工学会 化学工业出版社	编辑部主任	黄丽娟	国内统一刊号	CN 11-1954/TQ
编辑	《化工进展》编辑部	副主任兼广告负责人	胡晓丹	广告发布登记号	京东工商广登字20170106号
出版	化学工业出版社	编辑部电话	010-64519500/9501/9502	订 阅 处	全国各地邮局
通讯地址	北京市东城区青年湖 南街 13 号	广告部电话	010-64519466/9499	邮发代号	82-311
邮 编	100011	印 刷	北京科信印刷有限公司	海外总发行	中国国际图书贸易集团有限公司
E - m a i l	hgjz@263.net	开 户 银 行	中国工商银行北京和平里支行	国外发行代码	M3231
网 址	www.hgjz.com.cn	账 户 名 称	北京进展期刊社	定 价	95 元(国内) 20 美元(国外)
		银 行 账 号	0200004219200176319		



Contents

Invited review

Recent advances in the oxidation of cyclohexane catalyzed by metalloporphyrins ···*SHEN Haimin, WANG Yan, SHE Yuanbin* (2031)

Chemical processes and equipment

- Research progress in a rotating foam reactor·····*YANG Yucheng, YANG Shiyong, MOSES Arowo* (2046)
Rethinking the construction of intelligent factory in process industry·····*ZHAO Lujun, RONG Gang* (2053)
Model predictive control for zone tracking with economic cost function·····*HU Mingfei, XU Jun, LUO Xionglin* (2060)
Heat transfer characteristics of super-hydrophilic and super-hydrophobic matched ultra-thin heat pipe
·····*LIU Changquan, XU Jinliang, JI Xianbing* (2067)
Differential evolution using adaptive strategy for parameter estimation of chemical reaction kinetics
·····*XU Bin, CHEN Xu, TAO Lili, ZHANG Haifeng* (2077)
Analysis of pressure drop and simulation of gas flow field of new rotating bed with radial blades
·····*LU Jiadong, WANG Guangquan, TANG Di, GENG Kangsheng, ZHENG Bin, JI Jianbing* (2084)
Hydrodynamic investigation of liquid-solid flows in horizontal narrow rectangular channel
·····*REN Libo, ZHAO Xinqiang, ZHANG Shaofeng* (2092)
Experimental study and numerical simulation of solid alkaline slag depolymerization homogenizer structure
·····*ZHAO Bin, GAO Mingfei, DU Yajie, HUO Dianlong* (2101)
Heat transfer performance of double tube and double tube sheet safety heat exchanger with the reticulate inner tube
·····*MA Qian, LIU Xuedong, WEN Chuanmei, XIE Hongxiao, YIN Chuanzhong* (2109)
Influences of normalizing pretreatment on the start-up time of pulsating heat pipe
·····*WANG Ruixiang, YAN Mengfei, XU Rongji, XING Meibo* (2116)
Photo-thermal properties of hybrid CuO-MWCNT/H₂O nanofluids·····*QU Jian, ZHANG Ruomei, TIAN Min* (2125)
Effects of feed and draw spacers on the performance of pressure retarded osmosis
·····*SUN Shuocheng, LIU Yilun, CHEN Xi* (2132)

Energy processes and technology

- Digital transformation of oil & chemicals under the contemporary situation: from digital to intelligent·····*WU Qing* (2140)
Life cycle assessment of technologies for hydrogen production—a review
·····*XIE Xinshuo, YANG Weijuan, SHI Wei, ZHANG Shengsheng, WANG Zhihua, ZHOU Junhu* (2147)
Hydrolysis of cellulose in dilute acid solution by NaOH / Urea freeze - melting pretreatment
·····*XING Jingrun, SHEN Feng, QIU Mo, QI Xinhua* (2159)
Atomization characteristics of biodiesel immersion blown·····*DENG Weipeng, ZHANG Xiaohui, FENG Libin, WANG Hua* (2166)
Catalytic fast pyrolysis of bamboo pretreated by microwave using modified HZSM-5 catalyst
·····*SHI Kun, ZHONG Zhaoping, WANG Jia, LI Zhaoying* (2175)
Characteristics of natural gas hydrate slurry formation and flow in systems with wax and anti-agglomerates
·····*SHI Bohui, YONG Yu, LIU Yang, LI Mozhu, DING Lin, LÜ Xiaofang, WU Haihao, GONG Jing* (2182)
Pilot-scale study of upgrading a low temperature coal tar distillate for the production of clean fuels
·····*CUI Wengang, LI Dong, FAN An, PAN Liuyi, NIU Menglong, LI Wenhong* (2192)
Analysis of natural gas hydrate formation process in porous media and SDS complex system
·····*LIU Zhiming, SAHNG Liyan, PAN Zhen, SUN Xiuli, WANG Zhe, HOU Pengpeng* (2203)

Industrial catalysis

- Research progress of catalyst in catalytic hydrogenolysis of glycerol to 1,2-propanediol
·····*WANG Huiguo, WANG Hongyu, LUO Guohua, XU Xin* (2214)
The effect of silylation on the catalysts for naphtha selective upgrading
·····*WANG Yinbin, WANG Yang, ZANG Jiazhong, GUO Chunlei, PENG Xiaowei, LIU Guanfeng, YU Haibin* (2222)
Continuous catalytic ammoniation of tetrahydrofuran to pyrrolidine: catalyst and process
·····*ZHA Jie, QIAN Junfeng, SUN Fu'an, CHEN Shengchun, HE Mingyang, CHEN Qun* (2230)
Preparation of mesoporous zirconium phosphate and its catalytic performance in the preparation of cellulose from glucose
·····*YU Bo, LIU Chao, LIU Jindong, DING Wanyu, CHAI Weiping* (2236)
DeNO_x performance and resistance to H₂O and SO₂ of Mn-Ce doped V-W/Ti catalyst at middle-low temperature
·····*HUANG Jin, ZHONG Zhaoping, ZHU Lin, XUE Jianming, XU Yueyang, WU Peiting* (2242)
Catalytic performance of bimetal modified Co/Cu-USY zeolite for ethylbenzene oxidation reaction
·····*DING Wei, HAO Yuanchuan, SUN Yu, SHEN Jian* (2249)

Materials science and technology

- Progress of seasonal solar energy storage using supercooled salt hydrate phase change materialsZHU Maochuan, ZHOU Guobing, YANG Fei, TIAN Fukuan (2256)
- Modification of zeolite materials and their adsorption properties for the pollutants in aqueous solutionWANG Linlin, ZHANG Zhiming, DING Aqiang, CHENG Ran, ZHANG Mingjie, WU Donglei (2269)
- Review of research on the effect of salt storage deicing material on the performance of asphalt mixtureZHANG Zhengqi, LUO Yaofei, ZHAO Fuqiang (2282)
- Process in the preparation and application of polycarbonate diolsSONG Menglu, YANG Xiangui, CAI Xiaodong, WANG Gongying (2295)
- Synthesis of hierarchical ZnCo₂O₄ microflowers assembled by mesoporous nanosheets and their applications in high specific energy lithium ion batteryWANG Tianxing, WANG Hequan (2302)
- Preparation and performance of flexible and transparent CuS conductive film SUN Yueyue, LÜ Liyun, WANG Hong (2309)
- Modification of phenolic resin and its performance in impregnating graphiteJIANG Fengyi, TIAN Mengkui, HAO Litong, SHAO Zhuhua, YANG Ying, LUO Xiangli (2316)
- Convection heat transfer characteristics of graphene-based phase change microcapsule slurriesSHEN Junfeng, ZOU Deqiu, LIU Xiaoshi, GUO Jiangrong, HU Yunping, HU Zhigang, LIU Mo (2323)
- Oxidation diffusion and pore structure evolution model of graphite lining for rare earth electrolysisLIU Qingsheng, LI Jianglin, ZENG Shaojun, LIAO Chunfa (2331)
- Preparation and electrochemical performance of capacitive carbon derived from corn cobQU Xiaoxiao, XING Baolin, KANG Weiwei, ZHANG Chuantao, HUANG Guangxu, ZHAO Huihui, TIAN Ye, GUO Mengyao, ZHANG Chuanxiang (2340)

Biochemical and pharmaceutical engineering

- Balancing carbon flux rebalancing around phosphoenolpyruvate node for enhancement of FK506 production in *Streptomyces tsukubaensis*LÜ Mengmeng, LIU Jiao, LIU Huanhuan, CHEN Hong, WANG Cheng, WEN Jianping (2347)
- Optimization of fermentation conditions of the chitosanase-producing strain neps116 and enzymatic properties of the chitosanaseZHANG Xiang, ZHANG Yanhao, LIU Xiaoyong, XIN Xue, WANG Yifen, CHEN Leilei, ZHOU Qingxin, ZHAO Shuangzhi (2354)

Fine chemicals

- Effect of phosphate functional monomer on anti-clay properties of polycarboxylate superplasticizerZHANG Guanghua, WEI Jing, CUI Hongyue (2364)
- Synthesis and performance of a polyampholyte inhibitorYANG Yandong, RONG Kesheng, XU Shengjiang, LI Jianguo, YU Yongsheng, LI Jia (2370)

Resources and environmental engineering

- Progress in sticky characteristics of sewage sludge during thermal drying processLIU Yajun, WANG Aichun, DENG Wenyi (2378)
- Removal of zirconium and hafnium with ammonium *o*-iodobenzoate from the crude scandium oxideLIU Wei, HE Hanwei, YIN Zhifang, YANG Yang, CHEN Yuehua (2386)
- Purification performance of biogas slurry by blended CaO/PAC flocculantTU Te, RAN Yi, HE Qingyao, LIANG Feihong, WANG Ming, YAN Shuiping (2392)
- Advanced treatment of secondary biochemical effluent by CuO-Fe₂O₃/γ-Al₂O₃/H₂O₂/O₃YANG Wenling, GAO Zixing, WU Jiu, WANG Fangcha (2399)
- Analysis and optimization of post-combustion CO₂ capture system based on chemical absorptionHE Hui, FANG Mengxiang, WANG Tao, GE Kun (2406)

Applied technology

- Fly ash particle characterization of electrostatic precipitators and cooling agglomeration for fine particlesLIU Hanxiao, LI Jianguo, YAO Yuping, HE Yuzhong, CHEN Zhaomei, WANG Peng (2413)
- Simulation and optimization for azeotrope of ethylenediamine-water based on heat-integrated pressure-swing distillationHE Xiaoxu, QIAN Xinrui, YAN Liexiang, SHI Bin (2426)
- The properties of TBR tire belt produced from cleaning insoluble sulfurWANG Rongjie, SHEN Benxian, LIU Jichang, ZHAO Jigang (2432)
- A computer-aided design methodology for tailor-made surrogate fuelsZHANG Lei, LIU Linlin, DU Jian (2438)

Superintend: China Association for Science and Technology

Address: No.13 Qingnianhu South Street, Dongcheng District, Beijing, China

E-mail: hgjz@263.net
huagongjz@126.com

Sponsor: The Chemical Industry and Engineering Society of China; Chemical Industry Press

Post Code: 100011
Editor in Chief: TAN Tianwei

http: //www.hgjz.com.cn
Price: \$ 20

Editor: Editorial Department of Chemical Industry and Engineering Progress

Managing Editor: HUANG Lijuan
Executive Editor: XI Zhigang

ISSN 1000-6613
CN 11-1954/TQ

Publisher: Chemical Industry Press

Tel: (010) 64519466/9499/9500/9501/9502

CODEN HUJIEK